

## LIFE CYCLE OF MUSEUM PEST *ANTHRENUS FLAVIPES* (LEC.) (COLEOPTERA: DERMISTIDAE)

S. Kumar, L. Khamashon, P. Pandey, R. Chaudhary and P.C. Joshi

Insect Biodiversity Laboratory  
Department of Zoology and Environmental Sciences  
Gurukula Kangri University, Haridwar, Uttarakhand, India

### ABSTRACT

This study was aimed to record the complete life cycle of insect museum pest, commonly known as carpet beetle or furniture carpet beetle under normal room temperature and humidity. The eggs laid by female were  $39.4 \pm 6.08$  in number and incubation period was  $18.44 \pm 1.5$  days. The larval stages passed through  $7.12 \pm 1.12$  instars. The larvae were elongated, oval, reddish brown, about  $4.17 \pm 0.36$  mm long and covered with many brownish-black hairs. The larval stage persists up to  $291.04 \pm 11.26$  days from month of April, May to Feb, March. The pupae were developed inside the last skin. Pupa were yellowish white in color and lasts for  $18.24 \pm 1.58$  days. Adult beetles emerge after 18-20 days of pupation. Body of adult was  $3.05 \pm 0.20$  mm long and strongly convex, nearly rounded, color variable, brown or black and mottled with yellow or white scales on the dorsal surface; ventral surface clothed with white scales. The longevity of adult carpet beetle was  $35.8 \pm 3.05$  days, after mating female laid eggs. The duration of complete life cycle as observed was  $363.52 \pm 17.55$  days. This insect feeds on preserved insect specimens and damaged completely.

**Key words:** Carpet beetle, Museum pest, *Anthrenus flavipes*, pupae, life cycle

{**Citation:** S. Kumar, L. Khamashon, P. Pandey, R. Chaudhary and P.C. Joshi. Life cycle of museum pest *Anthrenus flavipes* (Lec.) (Coleoptera: Dermistidae). American Journal of Research Communication, 2013, 1(5): 219-225} [www.usa-journals.com](http://www.usa-journals.com), ISSN: 2325-4076.

### INTRODUCTION

Carpet beetle is among those insects that are destructive to household. It feeds not only on carpet but also cause serious damage to textiles, clothings, products of animal origin including wool, fur, feathers and skins. Some species of carpet feed on dried preserved museum specimens, others feed on cereals red pepper, rye, flour, mill powder, books etc. The larvae cause the damage. The adult however, were found feeding on flower pollens. They are mostly found in base boards, carpets, tables, book shelves, clothing etc. Four species of carpet beetles are usually encountered: *Attagenus magatome* (Fabr.) commonly known as black carpet beetle; *Anthrenus verbasci* (L.) commonly called varied carpet beetle; *Anthrenus scrophulariae* (L.) a common carpet beetle; and furniture carpet beetle, *Anthrenus flavipes* (Lec.). They vary slightly in size and coloration, but generally are similar and difficult to differentiate morphologically. Adult black carpet beetles, largest of these beetles, are oval and shiny black, similar to a ladybug, with brownish legs. The body length varied from 3.00 mm – 5.00 mm. Larvae are golden to dark brown and about 7.00 mm long with the body. A long brush bristles is at the tail end of the larvae.

Carpet beetles pass through the egg, larva, pupa and adult stages. Adults beetles feed outdoors on flower pollens, crepe myrtle and buckwheat. A single female can lay up to 100 or more white eggs, which hatch in 8 to 15 days depending on species and favourable conditions. Eggs were particularly laid near the food source, sometimes eggs were laid in air ducts, under heavy furniture, underneath baseboards, etc. Larvae begin their destructive feeding soon after hatching, avoiding light and molting several times as they develop. Kiritani (1958a, b) has worked on ecology of adult *Anthrenus verbasci* (Lec.). Nisimura and Numata (2001, 2003) Studied on endogenous timing mechanism controlling the circannual pupation rhythm of the varied carpet beetle *Anthrenus verbasci*. The normal habitat of *Anthrenus verbasci* species includes birds' nests (Woodmffe and Southgate, 1951)

The life cycle is shorter in places where the climatic conditions are favourable. It takes longer time during the winter. Generally in the spring, the pupae develop into new adults. Usually there are three to four generations were observed per year except for the black or varied carpet beetle, which may have one generation per year. Ariful Hasan *et al.* (2007) studied pest of stuffed museum specimen *A. scrophulariae*. Damage is caused by the larval stage, which develops over one to two years depending upon environmental conditions (Blake, 1958). The adult beetles feed on pollen and nectar of flowers in nature and are harmless. The adults fly around flowers to feed on pollens such as *Spirea* and hogweed (Woodroffe and Southgate, 1954). *Anthrenus flavipes* is a common species of wool-destroying insect in India. It feeds on woollen materials, feathers, bristles, furs, horse-hair, horny substances and other materials of a keratinous nature (Bry et al, 1982). Blake (1958, 1959) found a circannual rhythm governing seasonal cycles in a British population of this species.

Length of life, fecundity and the oviposition cycle in *Anthrenus verbasci* (L.) (Col., Dermestidae) as affected by adult diet Blake (1961). The biology of *Anthrenus sarnicus* Mroczkowski (Coleoptera: Dermestidae) was studied by Armes (1990, 1991). Gahlhoff (1997) studied on furniture Carpet Beetle, *Anthrenus flavipes* (LeConte) (Insecta: Coleoptera: Dermestidae).

## MATERIALS AND METHODS

This study was carried out in insect biodiversity laboratory in Gurukula Kangri University of Hardwar. Hardwar district covering an area of about 2360 sq. km. is in the Western part of the Uttarakhand state of India. Its latitude and longitude are 29° 58' N and 78° 13' E, respectively. Average temperature and humidity of the experimental lab varies between 14.29 °C to 36.64 °C and 52.5 to 85.31 %, respectively (Table 1).

Adult insects were collected from infested insects in collection boxes and kept in petridish at normal temperature and humidity and supplied dried insects. After eggs hatching, larvae were transferred to five different petridishes and kept till adult stage and supplied with the dried insects for nutritional purpose. Larvae of *Anthrenus flavipes* (Lec.) were carefully observed daily. The stages of the beetle were detailed and the developmental times were determined on different experiments.

## RESULTS AND DISCUSSION

**Oviposition and Egg development:** Eggs were deposited inside the hole in insect body created by larval stages or in other suitable crevices in infested insect boxes in the month of March and April. Each female lay up to  $39.4 \pm 6.08$  white eggs (Table 3) as compared to the number of eggs laid by varied carpet beetle (40), furniture carpet beetle (60), and black carpet beetle (90) as reported by Pest notes Publication, University of California (2001).

**Larval development:** After  $18.44 \pm 1.5$  days eggs hatch, to give larvae, which were elongate, oval, reddish brown, about  $4.17 \pm 0.36$  mm long (Table 3) and covered with many brownish-black hairs. The larvae persist for up to  $291.04 \pm 11.26$  days (Table 2) from month of April, May to Feb, March. Karren (2000) reported that the length of the larval stage is greatly influenced by the quality of the food source and the temperature. Larval stage of the different species varies from as short as 70 days to as long as 640 days in length. According to Pest notes Publication, University of California (2001) varied carpet beetle have 220-630 larval days, furniture carpet beetle have 70-94 larval days, and black carpet beetle have 166-330.

**Pupal stage:** The pupa was developed inside the last skin in month of March. Larvae were white in color and lasts for  $18.24 \pm 1.58$  days (Table 2). Number days of for pupation as reported by Pest notes Publication, University of California (2001) for varied carpet beetle was 10-13 days, furniture carpet beetle was 14-17 days while in case of black carpet beetle it was 8-14 days.

**Adult:** Adults were emerged in month of May, body of adults,  $3.05 \pm 0.20$  mm long (Table 3) and strongly convex; nearly rounded, color variable, brown or black and mottled with yellow or white scales on the dorsal surface; ventral surface clothed with white scales; 11 segmented antennae with 3 segmented oval clubs at tip; at rest, antennae lie in recesses in thorax; eyes indented on inner side; legs short, retracting into grooves on ventral surface; legs thickly clothed with yellow scales; larvae brown, bearing 3 bunches of golden hairs on tip of abdomen.

**Longevity of Adult:** The longevity of adult carpet beetle was  $35.8 \pm 3.05$  days (Table 2), after mating female laid eggs (Fig. 1). According to Pest notes Publication, University of California (2001) varied carpet beetle have 2-6 adult weeks, furniture carpet beetle and black carpet beetle have 4-8 adult weeks. A Md. Ariful Hasan *et al.* (2007) reported that the duration to the life cycle (egg to the death of adult) of the carpet beetle, *A. scrophulariae* was ranged 182-199 days. According to Koehler *et al.* (2011) the life cycle of this insect can take from 90 days to 2 years.

**Signs of infestation:** Sign of infestation of the furniture carpet beetle include feeding damage, larval cast skins and adults flying to light sources (Fig. 2). Since larvae feed in a limited radius, their shed skins accumulate giving the appearance of more larvae than are actually present. If you have an infestation of carpet beetles you will be able to find bodies of adult beetles and larval skin castings in light fixtures, on window sills and in the cracks of floor boards. Carpet beetle larvae leave clean neat holes in textiles with a fine powder the same color as the object left behind. By placing white paper in the bottom of boxes or on shelves, the powder left underneath the infested object will be clearly visible. Further thorough study on this pest is required for its eradication.

**Table 1: Mean temperature ( $^{\circ}\text{C}$ ) and humidity (%) of the laboratory recorded during the study period**

S.N.	Months	Temperature $^{\circ}\text{C}$	Humidity %
1.	January	14.29 $\pm$ 0.86	67.19 $\pm$ 1.70
2.	February	18.08 $\pm$ 0.53	64.00 $\pm$ 2.00
3.	March	27.10 $\pm$ 0.79	65.61 $\pm$ 2.28
4.	April	31.78 $\pm$ 1.03	53.14 $\pm$ 2.11
5.	May	36.64 $\pm$ 0.98	52.50 $\pm$ 1.50
6.	June	35.71 $\pm$ 1.70	61.57 $\pm$ 2.63
7.	July	32.28 $\pm$ 0.86	83.71 $\pm$ 3.63
8.	August	27.42 $\pm$ 1.55	85.31 $\pm$ 2.49
9.	September	27.50 $\pm$ 1.31	82.00 $\pm$ 2.16
10.	October	25.97 $\pm$ 1.53	78.91 $\pm$ 1.31
11.	November	20.12 $\pm$ 1.32	74.07 $\pm$ 2.04
12.	December	15.82 $\pm$ 0.74	70.00 $\pm$ 2.44

**Table 2: Mean duration (day  $\pm$  SD) for biological stages of *Anthrenus flavipes***

S.N.	Stages/instars	Days
1.	Eggs hatching	18.44 $\pm$ 1.5
2.	Larvae	291.04 $\pm$ 11.2
3.	Pupae	18.24 $\pm$ 1.50
4.	adult	35.80 $\pm$ 3.05
5.		

**Table 3: Mean no of eggs, larval instars and mean body length of larvae and adult of *Anthrenus flavipes***

S.No.	Stages	Number	Stages	Length of body(mm $\pm$ )
1.	Eggs	39.4 $\pm$ 6.08	Larvae	4.17 $\pm$ 0.36
2.	Larval instars	7.12 $\pm$ 1.12	Pupae	2.87 $\pm$ 0.11
3.			Adult	3.05 $\pm$ 0.20

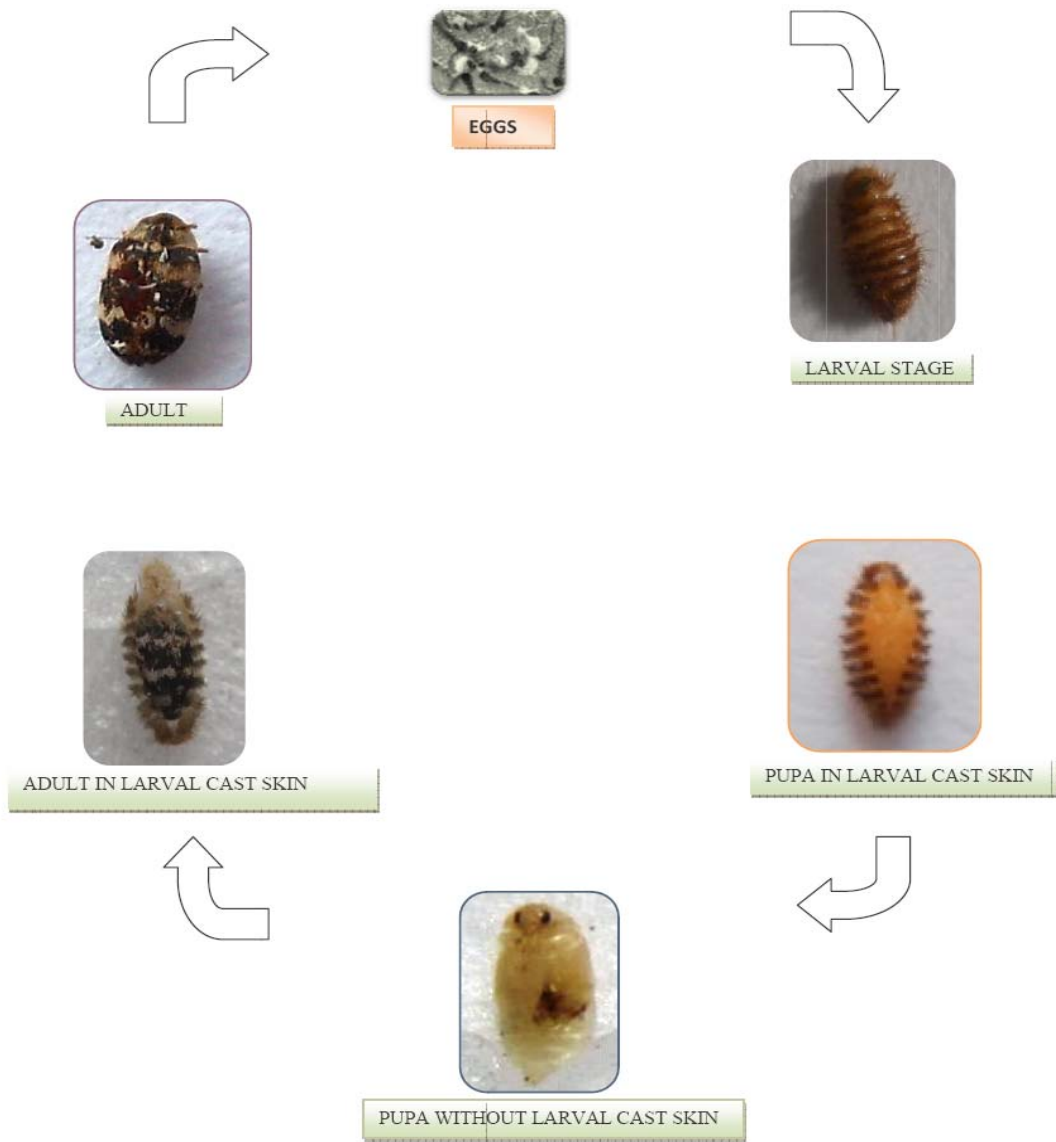
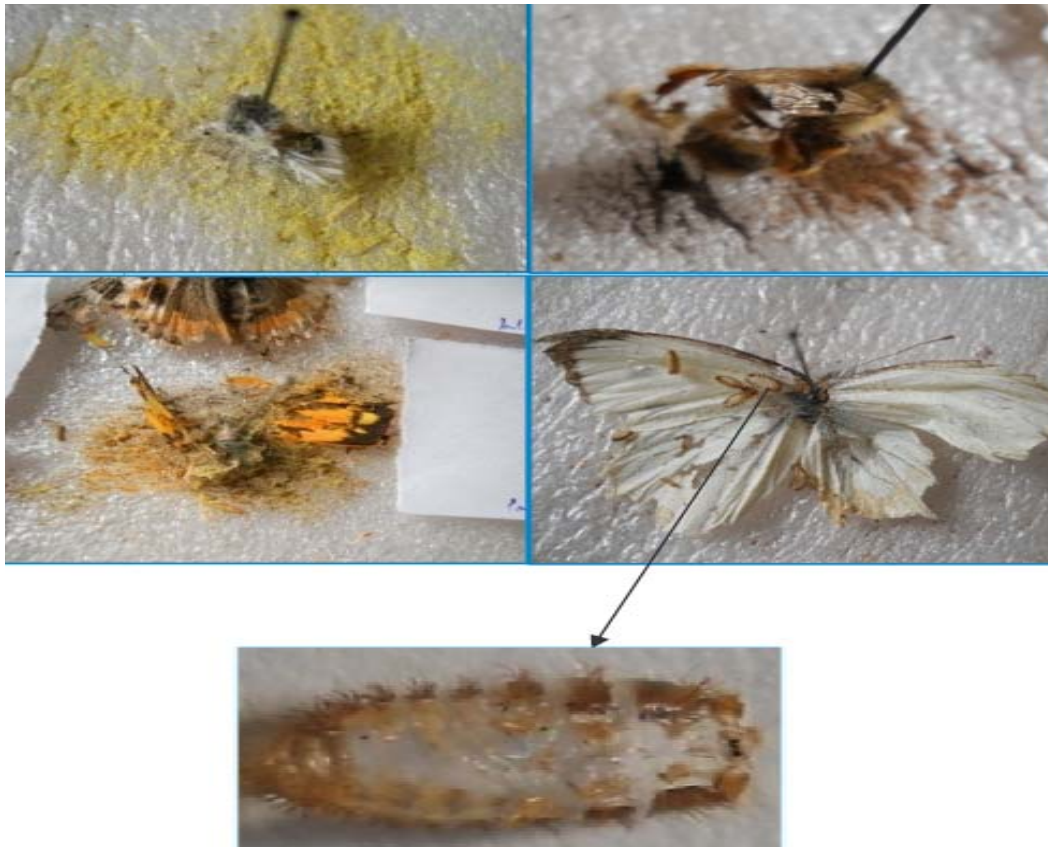


Figure 1: Life cycle of *Anthrenus flavipes*



**Fig. 2:** Photos showing damaged insects and pupal cases of larvae of carpet beetles.

#### ACKNOWLEDGEMENTS

Authors are thankful to University Grants Commission, New Delhi for providing financial support to carry out this experiment.

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